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MICRO JOURNAL

VOLUME II ISSUE 2 • Devoted to the 68XX User • February 1980
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(Letters to the Editor for Publication) All 'letters to the Editor' should be substantiated by facts. Opinions should be indicated as such. All letters must be signed. We are interested in receiving letters that will benefit or alert our readers. Praise as well as gripes is always good subject matter. Your name may be withheld upon request. If you have had a good experience with a 6800 vendor please put it in a letter. If the experience was bad put that in a letter also. Remember, if you tell us who they are then it is only fair that your name 'not' be withheld. This means that all letters published, of a critical nature, cannot have a name withheld. We will attempt to publish 'verbatim' letters that are composed using 'good taste.' We reserve the right to define (for '68' Micro) what constitutes 'good taste.'

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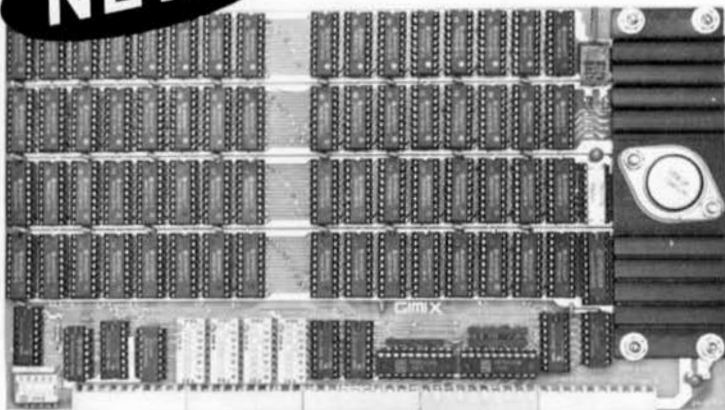
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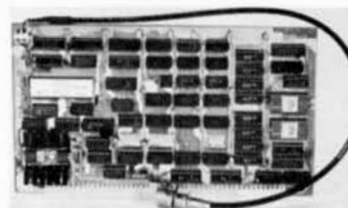
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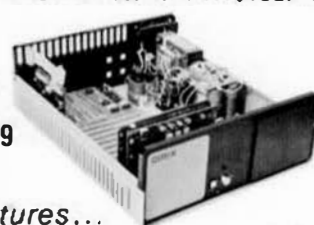
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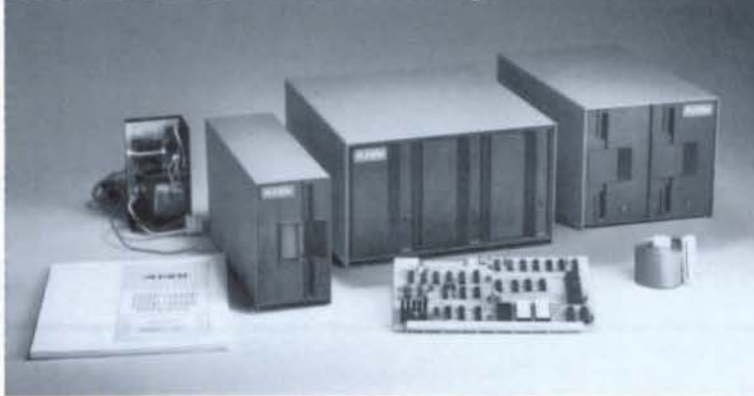
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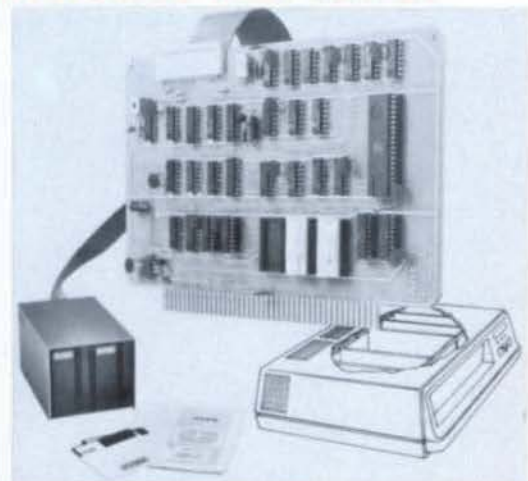
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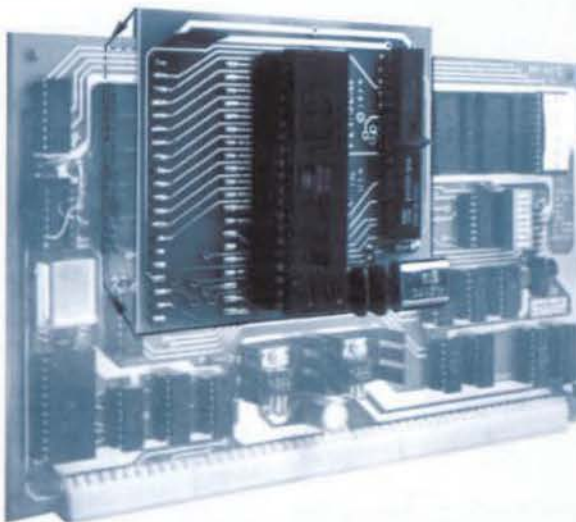
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of 6800 Microcomputing.

6800/6809 SOFTWARE

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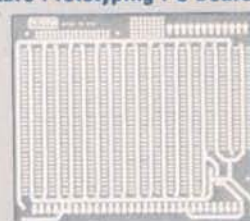
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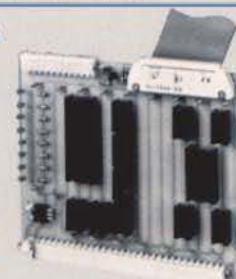
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SSB Dos Version 5
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SSB TSC FLEX Version
PERCOM INDEX
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JPC TC-3 Cassette System
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MM Enterprises and Springbok Digiltronics, SPIRIT (disk SSB) and a copy of STD-1, these will be awarded for 'best of SSB DOS. Value \$110.00.

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PERCOM, Assorted hardware and software, items to be listed next month

Final decision shall be delegated to a panel of judges selected by the staff of 68 Micro Journal™. All judges decisions are final and each person submitting, shall by his or her submitting material for evaluation, acknowledge that they agree to abide by any and all rules of this contest, as published within the pages of 68 Micro Journal™.

Programs and material submitted shall be judged on the basis of good and workable software. By this we mean, it should do something useful and be needed by the average 6800/09 user in the particular category. Size is of little importance, the most important consideration will be how useful it is.

All material submitted shall remain the property of the original owner (who should be the author). Each submission shall contain a paragraph that states the material submitted is of original design and the property of the person in whose name it is submitted.

It shall be understood that regardless of who wins or does not win a prize, all material submitted shall be authorized and eligible, to be published by 68 Micro Journal™. Material published, which was not a winning entry, shall gain the author an extension to his or her subscription. Anyone may enter and it is not a requirement that the person submitting material be a subscriber to 68 Micro Journal™. Prizes will be awarded on the quality of the material submitted and being or not being a subscriber, will have no bearing.

Full details may be secured from previous issues of 68 Micro Journal™.

AN I N D E X
to the
"68" MICRO JOURNAL
Compiled by Jim Schreier

Preface

Few Microcomputer publications can match the variety of the 1979 issues of the "68" MICRO JOURNAL. The 200 plus entries of this Index will be proof enough. My 6800 interest was created a few years ago when it was discovered the 6800 systems were the only ones to make sense. And they worked. And worked. In almost three years my SWTPC 6800 went down once. It blew a fuse. So you see, the "68" MICRO JOURNAL has a good act to follow: It makes sense and provides excellent information.

The thousands of MICRO JOURNAL readers probably keep back issues under protective custody. And, based on the assumption that the average reader's ability to find a specific article, news release, product announcement, review or letter is no better than mine, an Index is a must. Some microcomputer magazines are made to look nice, some aim at the hippie market (yet!); but the MICRO JOURNAL is, like a three course meal, made to be enjoyed and digested.

This Index covers everything but ads. Some of the page layouts in early issues are not clear, however any Index errors are my responsibility. The Index was prepared using the TSC FLEX2 Text Editor, Text Processor and Sort/Merge Package. Five fields were established after examining the various type source entries. Since the sources contain two type of entries the fields had to have certain common elements for proper layout. Normally the "no entry" character ("-") would be edited out prior to the final Text Processor pass. In order for MICRO JOURNAL users unfamiliar with Text Processing to observe these items, "no entry" characters have been retained. The FLEX2 DOS TTYSET WD command was set at 42.

It is my hope that the labor represented in this Index may be of current and future value to that special group of people, the "68" MICRO JOURNAL readers.

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Micro-time 6800 Review

The Micro-time 6800 is a stand alone real-time clock and calendar. This means that no system overhead or interrupts are required for time keeping as in some other system clocks. The clock is timed by a quartz oscillator with a trimmer capacitor for fine tuning. This allows operation without need for timing from the sixty Hertz power source and steering diodes are provided to allow operation from separate dc power sources or for battery backup to keep the clock running during power blinks.

The clock board plugs into a standard 30 pin I/O port and has a connector on top where manual time and date set switches may be attached.

The software provided with the board is in three sections. The first section when called as a subroutine, updates the time and date in a scratch area in ram. The second routine prints the time and date on the I/O device in the form: "12/17/79 10:35:22 PM EST". The last routine is used to set the clock and calendar.

The clock board is offered just as a bare board with connectors and documentation or factory assembled and tested. The assembled unit is available in either a switch settable version or software settable. The version which was sent for evaluation was the software settable version and seems to be well worth the few extra bucks that it costs.

The software was provided with a commented source listing, which was fortunate since I had to reassemble for my 09 system. Incidentally, when reassembled for the 09, the code was about 101 longer; however, when optimized for the 09, the needed code required approximately 151 fewer bytes than the 6800 version.

The documentation supplied is complete and explains operation adequately. The quality of the board and components used is good and the advantage of not having to worry about loosing the time every time the reset button is pressed, as happens with the clock I have been using, makes this device a worthwhile addition to any 68XX system. Other accessories include an A/C adapter for powering the clock while the computer is turned off and a Kansas City cassette with the previously described software. The Micro-time 6800 is available from :

THE DATA MART
914 E. WAVERLY DRIVE
ARLINGTON HEIGHTS, IL 60004

A 68 Micro Journal™ lab rating of: AAA

Rating Scale:

AAA - Excellent

AA - Good

A - Fair (could be better but works)

P - Poor (may not always work properly)

X - Not recommended for children
(or anything else!)

PERCOM PROTOTYPING BOARDS REVIEW

Percom Data Company has recently announced two new 68XX prototyping circuit cards. One card fits the standard SS-50 bus and has enough room to accomodate up to 70 14-pin DIP sockets or less 16,24, or 40-pin sockets. The top of the board has pads for insertion of a 34-pin and a 50-pin ribbon cable connector. One side of the board provides an area for miscellaneous circuitry or test points. DC power for the board is fed from the 8-volt bulk supply and goes to circiut pads for a 5-volt regulator. From the regulator a plus supply buss feeds between alternate rows of pads so that it is close to all circuits. A ground buss passes between opposite alternate rows also in close proximity to all circuits.

The second board is a SS-30 bus board. It has room for up to 34 14-pin DIP sockets or less larger sockets. The top edge provides pads for one 12-pin Molex connector and a 34-pin ribbon cable connector. A small area is also provided at the top for other miscellaneous circuits, indicators, or test points. The SS-30 board also has pads for a 5-volt regulator and positive supply and ground busses close to all socket locations. Both boards are single sided, solder plated, and up to Percoms usual high quality.

One thing that I watch closely on 68XX boards is how well the mother board molex connectors fit. There is nothing that bothers me more than boards that fit onto the mother board at a 30-degree angle. The Percom boards passed this test well. The quality of the boards is excellent and allow for optimun placement of IC's and components. The only complaint that I have is the fact that there is no identification of any of the mother board signals on the board. This would have made use of the boards somewhat easier. The boards are available from:

PERCOM DATA COMPANY, INC.
211 N. KIRBY
GARLAND, Texas 75042

A 68 Micro Journal™ lab rating of: AAA

Rating Scale:

AAA - Excellent

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A - Fair (could be better but works)

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(or anything else!)

J.B.I. CT1024-64 High Speed Conversion

If you are like a lot of the rest of us 68XX users, you still use one of the SWTPC earlier terminals. The SWTPC CT-1024 and CT64 were two of the most popular video display units for 68XX users. They were low in cost and worked reasonably well. The keys were sometimes balky or at other times self striking. This was annoying but not fatal to the operation. The screen when refreshed looked like a midwest blizzard and occasionally the cursor developed a mind of it's own,

wandering here and there at will. One of the most annoying drawbacks was the slow write speed of either. Three hundred baud was the normal and twelve hundred baud was the upper limit, and still is until you install the J.B.I. conversion kit. Despite these and other occasional quirks; the CT-1024 and CT-64 were and still are in use by thousands of micro users worldwide today.

The J.B.I. conversion kit eliminates many of the major drawbacks of the CT series of video displays. It can be adapted to those units that have been field-updated with 64 character mod (CT-1024) and other popular changes. It uses a DMA method of screen memory, essentially causing the terminal memory to become computer memory. By this scheme the screen can be written to at near computer speed. Screen writes can range from one character per second to 4,000 characters per second (40K baud). All of the memory management (terminal) is still accomplished by the terminal and leaves the CPU unburdened for these chores. BASIC can 'POKE' directly any character position (limited graphics) and 'PEEK' any character position.

Terminal memory can be relocated to any 1K block in computer memory range that is available. This requires a software change of three standard Mikbug™ routines. These are the ones used in screen write, e.g. \$E1D1 OUTEEE, \$E1AC INEEE and \$E07E PDATA. Patches are furnished for practically all popular software.

The board has been run on 2 meg machines and requires no delay. Included with the kit is a source listing of all changes or patches. The supplied software is RDMable. The converted terminal allows software control over scrolling or paging. One foil cut on the terminal eliminates the 'snow' problem when using the conversion kit. Baud rates are controlled from the keyboard or from software. It honors the tape 'SAVE and LOAD' thru BASIC at 300 baud. Existing software requires only a change of the three routine references to run in the converted mode.

COMPUTER MODS

If you are still using the MP-C I/O board in slot 1 you will be required to lift one IC pin on the board, this eliminates 'echo' to the terminal. No changes are

required to the computer if you are using a serial 'MP-S' I/O board.

MODS FOR CT-64

One trace cut and two IC pin cuts (or lift out if you are using sockets) also one wire jumper added.

MODS FOR CT-1024

One IC pin lift or cut and two grounds extended. One or possibly two wire extensions.

The conversion comes with two boards connected by two ribbon cables. The boards are factory built and require only memory chip installing if you use your own. One board fits on the computer S50 bus and the other replaces the memory board in the terminal. The kit comes with or without out memory IC's. This way you can use your old 2102 memory chips (if they are in sockets) or can be ordered with all new memory chips (2 Mhz). The prices advertised are \$169.00 with you supplying the memory chips. If you order with new memory chips the price is \$179.00. We recommend that you order with new chips as most all older chips are slow and end up looking like worms are eating portions of some characters, interesting but annoying!

One note of caution if you are going to update a CT-1024 you need to let them know if it has been modified for 64 characters per line or is original.

The documentation seems very complete and should be useable by anyone who originally constructed his terminal. It comes with 12 pages of instructions, diagrams, board layouts, software patches and assembled source code.

Additional information can be secured from:

JOHNSON MICRO COMPUTER
2607 E Charleston
Las Vegas, Nevada 89104
1-702-384-3354

A 68 Micro Journal™ lab rating of: AAA

Rating Scale:

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A - Fair (could be better but works)

P - Poor (may not always work properly)
 X - Not recommended for children
 (or anything else!)

CORESIDENT JBUG AND MINIBUG II MONITOR ROM FOR MEK6800S2 MICROPROCESSING SYSTEM

K. Russell Peterman, Staff Scientist
 Radian Corp. 8500 Shoal Creek, Austin, TX
 78766

The Motorola MEK6800D2 microprocessor system features a hexadecimal keypad for data/address entry and a 7-segment LED array for data/address display. The system also utilizes one ACIA as a Kansas City Standard audio cassette interface. The JBUG ROM monitor supplied with the system will support the functions outlined in Table 1, including audio cassette read/write capabilities. However, during applications program development it is much more productive to use an external crossassembler such as M68SAM (Ref.1) for building object files. When the crossassembler is resident in a larger computer or development system, this almost always implies an RS-232 serial interface standard for data communications between the data terminal and the resident crossassembler. Thus, for prototyping purposes, it would be ideal in a system such as the MEK6800D2 to provide coresiding ROM monitors to format I/O data for either the hex keypad/audio cassette (JBUG) or an RS-232 serial data communications port (MINIBUG II) (Ref.2) as shown in Fig. 1. Although Motorola has released an excellent applications note (Ref.3) outlining the modifications required to allow coresiding ROM monitors in the MEK6800D2, their scheme is somewhat complex, so that it can provide program control of which ROM monitor is addressed. However, in many applications the monitor need simply be selected manually using a front panel control switch. In this manner applications program development could proceed from a source file in the development system machine to an ASCII coded object file on a digital cassette tape. The object file may then be transferred from cassette tape, via RS-232 serial interface, to the RAM resident in the MEK6800D2 system using the MINIBUG II monitor. The ROM control may then be switched to JBUG to allow complete system control of the MEK6800D2 from front panel keypads.

To implement this scheme, only one control signal need be switched between the two ROMs as shown in Fig. 2. The signal designated as ROM is output to the selected ROM by the JBUG/MBUG switch, shown in the figure. The upper portion of the switch also parallels the Tx clock and the Rx clock of the ACIA (U23), as shown in Fig. 1, when the MBUG ROM monitor is selected. Adequate space is provided on the MEK6800D2 board to add the second MC6830 ROM as shown in Fig. 1 as well as the RS-232 driver-receiver shown

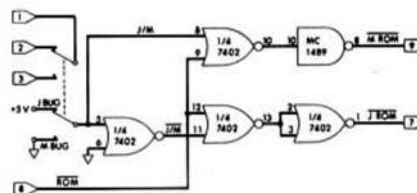
in Fig. 2. Note also that in order to ensure that no data are lost during monitor switching the MC6800 microprocessing unit should be held in the reset condition while the JBUG/MBUG switch is changed. The MEK6800D2 system provides baud rate logic for standard rates up to 9600 baud which may be selected at the output taps of counter U17. The JBUG ROM is normally supplied with the MEK6800D2 system; however the MINIBUG II ROM may be specified separately by asking for an MEX68MIN II preprogrammed MC6830 read only memory.

REFERENCES

1. M68SAM is the property of Motorola SPD, Inc. Copyright 1974 to 1978 by Motorola, Inc.
2. Motorola Semiconductor Products, Inc., Applications Note AN-771, "MEK6800D2 Microcomputer Kit System Expansion Techniques", Motorola Semiconductor Products, Inc., Phoenix, Arizona, 1977.
3. Motorola Semiconductor Products, Inc., "Evaluation Module II User's Guide", Motorola Semiconductor Products, Inc., Phoenix, Arizona, 1976.

TABLE I

Monitor Function	JBUG	MINIBUG II
Display Registers	R	R
Load From Tape	L	L
Dump to Tape	P	P
Memory Examine/Change	M	M
Execute from Entered Address	G	G
Set Terminal Baud Rate	-	S
Test Memory	-	W
Punch Binary Tape	-	Y
Load Binary Tape	-	Z
Abort Program Execution	E	-
Trace (Single Step)	N	-
Set Breakpoint	V	-
Reset Breakpoint	V	-
Continue Execute from Breakpoint	E,G	-
Delete All Breakpoints	V	-



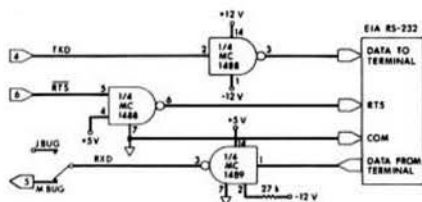


FIGURE 2
M6800 D II
DUAL MONITOR LOGIC
CIRCUIT DIAGRAM

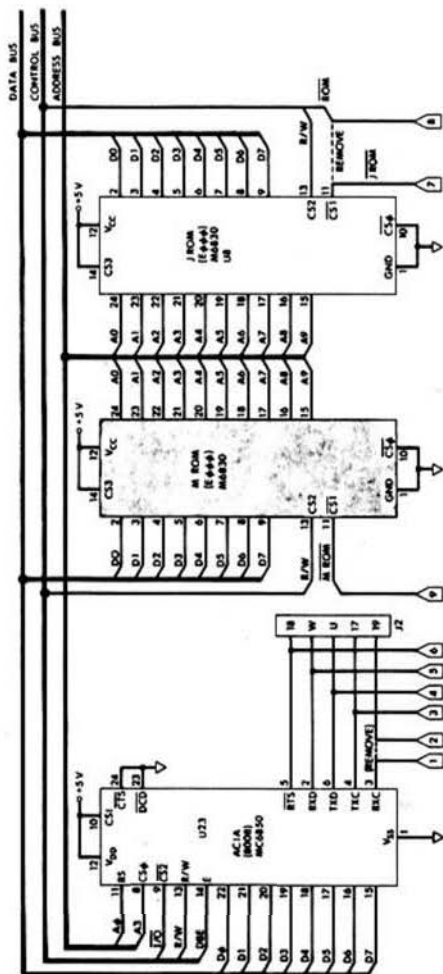


FIGURE 1
M6800 D II
DUAL MONITOR I/O LOGIC
CIRCUIT DIAGRAM

USING THE 6801/6803 AND 6809 IN THE MP-A2 BOARD

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Both the 6801 (or 6803) and the 6809 MPU chips can be used with the SWTP MP-A2 board with simple adapters. This article describes this approach to use both the 6801/6803 and 6809, in adapters, with TSC software.

First examination of the 6801/6803 specifications reveals a faster processor with equivalent 6800 instructions, plus some added instructions (Table I). Tests show that the 6801/03 runs typically 17.51 faster than the 6800 at the same clock frequency. The only disadvantage of the 6801/03 is the inability to use the first 20 Hex addresses in memory. These addresses have the special purpose registers and ports and are not available for memory use on the direct page. The pin-out of the 6801 and 6803 is not equivalent to the 6800 and an adapter is required. A circuit of an effective adapter is shown in Figure 1. With this adapter, and a jumper header substituted for the 6875 (as for the 6809, 68MJ6P6) on the MP-A2 board, the 6801 or 6803 runs most programs without any modification of the monitor or software. The only notable exception is disk versions of SWTPC BASIC (and possibly other versions). The TSC Editor, Assembler, BASIC, etc., operate properly.

Some additional advantages of the 6801/6803 include the availability of a programmable timer and a direct page ACIA port, the availability of 16 bit arithmetic shift instructions, PSX, PULX and 8 bit multiply. The only disadvantages are the loss of 20 Hex bytes of memory on the direct page, and the inability to use DMA readily. Since most software for the 6800 also runs on the 6801/03 little difficulty should be experienced with this modification.

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The 6809 may be used with the SWTPC MP-A2 board with simple adapters like the PERCOM. Some difficulty was experienced with this adapter on my system since a PIA port would not operate properly. The solution was found in pulling VMA high with a 1K resistor rather than by using E

AND Q. The 6809 in a simple adapter requires a new monitor. The easy approach is to modify the SWTPC S-BUG monitor for the standard 8000 Hex I/O normally used with the MP-A2 board. This is simpler than modifying the MP-A2 board to allow the EOXX addresses to be put on the main buss. These addresses are only used with the on-board EPROM or monitor. The contents of the monitor addresses in Table II should be changed from EO to 80 to modify the ACIA location for the control port (only a MPS card!) and the 5 addresses for the mini-disk boot. This can be done by reading the standard S-BUG monitor into the EPROM programmer routine, modifying the addresses in memory, and programming a 2716 with the new code.

To modify TSC software to run on this system, it is only necessary to change the EOXX addresses in NEWDISK.CMD and FLEX.SYS. Once these addresses are changed, a new disk is formatted, these two programs copied onto the new disk and the modified FLEX.SYS LINKed, the new disk will boot and operate properly with the utilities. These changes may not be simple to make with only a 6809 disk and a single system. Here are two approaches.

First, if FLEX 2 is available (FLEX at 7000 will not work) it can be brought up and with memory from A000 to DFFF, GET,FLEX.SYS from the 6809 disk to place FLEX.SYS into memory. Change all EO addresses (Table III) to 80 and SAVE,FLEX.NEW,C700,DF4D,CA00 on the 6809 disk. NEWDISK.CMD can be modified and saved similarly (see Table IV). This still does not allow the disk to boot even when linked, however, because the track 00 boot sector still contains EO addresses. Only disks formatted with the modified NEWDISK command will boot with 8000 I/O.

If battery back-up for C000-DFFF is available to maintain FLEX 9 in memory, the system can be shut down, converted to a 6809 system and reset. Upon jumping to CD00 or CA00, FLEX 9 works properly. From here, NEWDISK a blank disk with the modified utility, copy FLEX.NEW to it and LINK,FLEX.NEW on the new disk.

This new disk will now boot properly and the system is up. The next approach can be used if FLEX 2 is not available and will work if no battery back-up is available for the RAM memory.

1. Boot the 6809 disk using the modified S-BUG and memory at C000-DFFF, reset, one sector will have loaded at C000.

2. Change all EO addresses in this sector (Table V).

3. Set X to C000, jump to C000. This will cause the disk to load FLEX.SYS, but hang up, so reset again. Change all EOXX addresses (Table III) and jump to CD00.FLEX 9 will be operating.

4. SAVE,FLEX.NEW,C700,DF4D,CA00. Modify and save NEWDISK as above.

5. Format a new disk with the modified utility, copy FLEX.NEW and NEWDISK to this disk and LINK. The new disk will boot and all utilities will work properly.

Advantages:

1. No buss modifications or motherboard changes.

2. Low cost modifications allow use of both 6800 and 6809

3. All TSC software for 6809 can be used.

4. Up to 40K of memory is accomodated exactly as with the SWTPC board.

5. With the MOVE9 utility (by James Hughes), MINI-FLEX files are easily transferred to FLEX 9 disks.

Disadvantages:

1. Only 32K of useful memory is available vs 48K for I/O at EOXX.

2. Some initial software modification is required.

For those with Thomas Instrumentation video boards, a version of JOEBUG monitor (68MJ2) for the 6809 is also available to operate the video board, printer, keyboard and terminal ports simultaneously. FLEX 9 I/O must be modified for the video drivers however. It was noted in performing this modification that the jump table (D3E7-D3FC) is not normally used for CHAR in and CHAR out routines at D370 and D38B respectively and that jumps (7E XXXX) must be placed at D37D, INCH; D388, OUTCH; and D39C, STATUS to accomplish this modification.

TABLE 1. NEW INSTRUCTIONS IN THE 6801/6803

ABX	B+X -> X
ADDD	M, (M+1) + D -> D
ASLD	C <- D <- 0
LDD	M, (M+1) -> D
LSRD	0 -> D -> C
MUL	A x 8 -> 0

PSHX X -> Stack
PULX Stack -> X
STD D -> M, (M+1)
SUBD D - M, (M-1) -> D

TABLE II. S-BUG MONITOR I/O ADDRESSES

F825 (ACIA)	FBC8	FBDD
FBB1	FBCD	FBEB
FBB4	FBD6	FBFO

TABLE III. FLEX 9 FLEX.SYS I/O ADDRESSES

D3E1(Timer)	DE79	DEB9
D3E3(ACIA)	DE88	DECB
D3E5(ACIA)	DE8B	DEE6
DE40	DE90	DEFC
DE48	DE98	DF23
DE58	DEB1	DF28
DE71		DF32

SAVE,FLEX.NEW,C700,DF4D,CA00

TABLE IV. FLEX 9 NEWDISK.CMD I/O ADDRESSES

C479	C4BE	C626
C47F	C5ED	C627
C48E	C5F6	C633
C499	C603	C63F
C49E	C618	C65E
C4A4	C624	

SAVE,NEWDISK8.CMD,C100,C6A7,CA00

TABLE V. I/O ADDRESSES IN BOOT SECTOR

C015	C04C	C067
C01E	C04F	C086
C02B	C054	
C040	C05B	

REFERENCE 'BOOKEEPING' NEXT COLUMN

NOTE: Due to the volume of data in the BASIC programs we will furnish copies of the entire disk programs (.BIN and .BAS) for \$6.50 (miniflex format) including postage and handling. The BASIC programs will be run next month in source format.

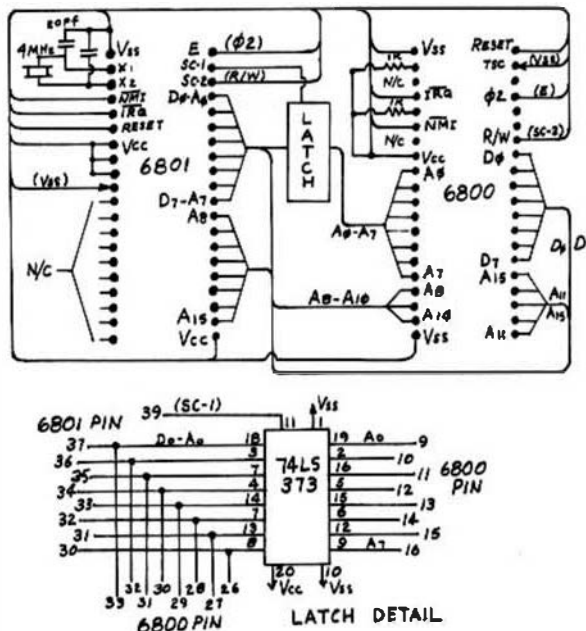


FIGURE 1 ADAPTER FOR USING 6801/03

BOOKEEPING (Disk & Tape)
MINIFLEX William R. Stock
1125 Lois Dr
Cincinnati, OH 45237

Totally ignoring the fact that my father kept adequate financial records with nothing more than a check register and 39¢ worth of index cards, I have convinced all concerned that my SWTPC 6800 is useful because it keeps my books. Assuming you have similar problems, this bookkeeping system may be for you.

It is written in SWTPC BASIC 3.0, intended to be used with the Southwest minidisk under miniflex 1.0. If you have another system you may have to modify the programs a little.

HOUSEHOLD NEEDS

The primary purpose of a household bookkeeping system is to keep a record of all income and expenses; the former for your friend and mine, the IRS, and the latter for you. However, if we're going to do this on a computer we may as well go ahead and list our assets and liabilities (debts). This gives a general ledger, and a much more comprehensive picture of our financial status.

To this base I have added a rudimentary Accounts Payable, to assist in projecting cash requirements.

Notice that this system is designed for households. Businesses will still have to look elsewhere.

DESIGN PHILOSOPHY

In any monetary record keeping system, accuracy is of paramount importance. As a result, this system uses a double entry ledger. A double entry system can get unwieldy, however, if you have to keep track of assets, liabilities, debits

and credits, and how they interact. This leads to the second design consideration: simplicity. be used if it is too complicated to operate. Consequently, this system was designed so that once it is booted up, all instructions are displayed on the CRT. The only debit/credit decisions you have to make are on the first entry of each transaction, and they are further simplified, as we shall show. Moreover, the programs call each other from disk, eliminating the need to remember what comes next.

SYSTEM REQUIREMENTS

This system was designed to run on (any) SWTPC 6800 with 20K RAM, a SWTPC 1124 terminal, SWTPC mini-floppies running TSC's miniflex 1.0 and BASIC 3.0 (the additional 4K required for miniflex is not included in the 20K), and the SWTPC AC-30 cassette interface + SWTBUC for tape backup of the data files.

The only programs unique to the SWTPC system are those dealing with the cassette. These programs are written in assembler, and interface with miniflex 1.0.

PROGRAM DESCRIPTIONS

POSTING: Transactions are entered into the books by the posting routine. The APIN program validates the transactions, makes the debit/credit decisions, and writes the transactions to the TRAN file. If any entries affect Accounts Payable, they are also written to the PTRAN file.

If any transactions were written to the PTRAN file, they are now sorted and the APMASER is updated. If there are any rejected entries, they are displayed and the program aborts.

The Journal APPEND program is called next, and it simply appends the transactions to those already present in the journal. This was done in BASIC to keep things simple.

Next, the TRAN file is sorted, and the GLMASTER is updated. At the same time, the sorted TRAN file is merged with GLHISTORY, to produce an updated file of G/L transactions. Rejected entries are displayed on the CRT.

JOURNAL PRINT: Occasionally you will want to look at some transactions. This program lists them as they were input, within either a date or a sequence number range.

TRIAL BALANCE: This program lists the asset and liability accounts, with or without a listing of the transactions on file. It reads, but does not display, the income and expense accounts to arrive at the surplus, which is needed to make the debits equal the credits. These two figures will always match (unless you have posted to an account not on file.)

PROFIT & LOSS: You are sometimes interested

in either how you made so much money, or where it all went. This program tells you. It reads the income and expense accounts, displays them, and by a clever algorithm (subtraction), gives you the amount of either profit or loss.

CASH REQUIRED: This is the only function of Accounts Payable at this time. The program tells you how much you need to meet the bills that will come due between the date of last update and the date you enter.

END OF PERIOD: Although the diskettes will probably hold a year's transactions, the update time can get rather long, so this program allows you to scratch the JOURNAL and the GLHISTORY, with the option of saving the data on tape. Should you need to refer back to the saved data, the RECOVERY program will put the data back to disk, from which you can run the usual trial balance and journal print.

END OF YEAR: To set up your books for a new year, this program performs the end of period function, then zeros out the income and expense accounts and updates the net worth.

MAINTENANCE: You will have occasion to add and delete accounts. This routine performs the task. It also allows you to change an account name, and, on the accounts payable file, change the date and amount due.

BUDGET: Since everybody talks about budgets, I have included a budget program. It will tell you how much you've budgeted for each expense account so far this year, how much you've actually spent, and what percentage you've spent.

PART II: OPERATION

Once you have created all the disks, bringing up the system is a snap. Power up your computer, put the SYSTEM disk in drive #0, and enter D (SWTBUC). The computer will eventually respond with:

READY

to which you respond: CHAIN 0,START.

This routine gets today's date and saves it for all subsequent processing. You now select a job from the CRT menu.

1 - TRANSACTION POST. There are two rules to remember when posting transactions. First, ALL ACCOUNTS MUST BE ON FILE. Second, THE FIRST ENTRY DETERMINES DEBIT/CREDIT FOR THE ENTIRE TRANSACTION. We will now look at each of these in detail.

Since a typical household chart of accounts will contain between 75 and 100 entries, it is not feasible to verify account numbers on the input run. (It is possible, but response

(line suffers terribly.) Consequently, it is imperative that you make sure each account number is correct. If a transaction contains items on file and items not on file, then some accounts get updated and some don't (because they're not there!), leading to an out of balance condition. (In which case you start over.)

My approach to the second rule might drive professional bookkeepers crazy, but it makes things simple. The computer knows, because you told it, which accounts are income, asset, liability, etc. It also knows, because the programs tell it, that increases to income are debits, and so forth. Furthermore, it can figure out, based on the first entry, the debit/credit status of each item. Consequently, to make things as simple as possible, I have adopted this rule: IF IT ADDS TO THE ACCOUNT BALANCE, ENTER IT POSITIVE. Consider the following transaction:

ACCT	AMOUNT	COMMENT
111	298.8	10/20
711	40.94	
712	15.92	
713	2.12	
714	5.52	
583	1.6	
322	20	
324	211.7	

You will notice that the first entry is positive. It adds to 'Dad's income'. The computer knows that 111 is an income account, and makes a positive entry a debit. It also knows that accounts 711 through 583 (in the example) are expenses, and makes these entries credits. 322 and 324 are assets, and these will be debits. The important fact is that YOU don't have to worry about anything but the FIRST ENTRY. The rest is taken care of for you.

Less obvious, but equally important, the second through last entries add up to the amount of the first entry. This is the basis of the double entry system. You cannot post a transaction unless this condition is met, which means you cannot get out of balance (unless you post to an account that doesn't exist, as we've already mentioned.)

When you have made the last entry of a transaction, the 'in balance' condition triggers a neat, columnar display of the transaction. The program asks if everything is ok. At this point you should double check the account numbers, and then answer yes or no.

If you have entered the last line of a transaction and the program doesn't list it out, then the transaction obviously is not in balance. Figure out why, press return, and re-enter it.

When you are finished posting all your transactions, press return without entering anything. The program asks if you are REALLY finished. Answer yes (or no, if you're not!).

There is one last remark about the input program. If you look at the example, you will notice that it looks sloppy. This is not because I am a poor typist, but because I am lazy.

It is far easier to hit the space bar than the comma, so the entire line is one INPUT AS command. The program picks AS apart, retrieving the account number, amount, and comment (if any). While this makes input easy, it does place one restriction on you: the fields must be separated by one, and only one, space.

2 - JOURNAL PRINT. The operator input to this program is minimal. It asks if you want the entire journal printed. If you answer 'no', it asks if you want the range based on date or sequence number. Depending on your answer, it asks for the beginning and ending dates or sequence numbers.

3 - TRIAL BALANCE. Trial balance asks only one question: do you want details to print. A 'yes' will display every transaction to every account that is on file. A 'no' will cause only the account number, description, and balance to print.

4 - END OF PERIOD. The only question is whether or not you want to save the data to tape. Answer yes or no.

5 - END OF YEAR. The same question for end of period is asked here.

6 - PROFIT & LOSS. There is no input to P&L. It runs all by itself.

7 - CASH REQUIRED. The cash required program must know the cutoff date you are interested in. It will add up the amounts due from the date of last update to the date you enter. Additionally, it asks whether or not you want it to display a list of which accounts and amounts are due.

The routine is limited by the fact that the amounts are added only once. Consequently, the date range should not encompass two payment periods.

8 - MAINTENANCE. Before we start talking about the input, let me remind you that all accounts must be accessed in ascending account number sequence. After you have all additions, deletions, and changes in sequence, you may start.

Enter the account number. If this is an old account you can 'return' through the description and it will stay the same. If it is a new account, enter the description. If it is an A/P account, enter the date due and amount due.

To delete an account, enter 'DELETE' for description. An account must have a zero balance to be deleted. Balances cannot be changed by maintenance.

To exit maintenance, hit 'return' without entering an account number.

10 - BUDGET. Printing a budget has no input and is no fun. Building a budget, however, is as close to a game as we will get with this pedestrian system.

First, let me warn you that the budget build program was designed to work off the previous year's actual expenses. As a result, it won't work until there is at least something in the general ledger balances.

The program starts out by asking you to select a budget period. Since we all pay as we go, we tend to think in weekly, monthly, etc., terms. And since our computer can multiply and divide, we will let it annualize our input.

Next, the program needs to know our best guess at our annual income. Guess too high and you'll be within budget, but show a loss. Guess too low and you'll have a rough time budgeting. I usually guess high, go over budget, and make New Year's resolutions.

The program now reads the general ledger expense accounts, computes what percentage of the total expense was spent on each account, computes what should be spent, and you're off to the races!

The repetitive display consists of the account name, the amount you have previously input, and the suggested amount. You now enter:

The item-by-item input is very flexible. It is so flexible, in fact, that it is simple to use and impossible to explain. Here are the possibilities:

(amount)(return): the amount entered replaces the previous amount. It is for the period chosen at the beginning of the program.

(amount),F(return): the amount entered replaces the previous amount as in the above example, and the account is then removed from further consideration (frozen).

(return): everything for this account remains the same.

F(return): Everything for this account remains the same and it is removed from consideration.

(amount),(period)(return): the amount entered is multiplied by the period entered, and the product divided by the initial period to arrive at the amount to be displayed. This is handy for things like insurance premiums.

(acct #),T(return): this places the entered account back into the matrix (thaws it). The disadvantage is that you have

When you have journeyed through all your expenses, the program will display how much you are over your income. It will then re-compute suggestions for all non-frozen accounts, and you play it again. Same.

When you have finally figured out how to live within your income, the final budget will print, and you will be asked if you want to revise it. If you say 'no', the general ledger is updated with the new budget. (OBVIOUSLY you run the budget build before the end-of-year program!!!)

In closing, let me point out that you can't freeze nothing (zero amount). You can, however, freeze a penny, which will have minimal impact on the results.

PART III: CONVERSION

Building all the disks required is the most difficult aspect of the whole operation. Not only is everything unfamiliar, but you are dealing with a great volume of data, all of which must be entered correctly. Take heart; you have to do it only once.

Since miniFLEX file organization precludes a destructive update (overwrite), either/son is the only technique available. This means the masterfile must be in ascending account number sequence.

Since the programs assume the lowest account numbers are income accounts, followed by receivables, assets, expenses, payables and net worth, your chart better follow this scheme. The available numbers are 1 through 99999999. Since the 1024 screen is 32 characters wide, I used 3 digit numbers.

With these restrictions in mind, we are ready to get started.

First, NEWDISK a box of diskettes. You will need at least seven, and ten is better. (One SYSTEM, and two or three each GENERAL LEDGER, JOURNAL, and ACCOUNTS PAYABLE.)

Next, write labels for each diskette, so when things start to move you know what's what.

Place your miniFLEX disk in #0. This is the disk you got when you bought your computer. Place the newly NEWDISKed disk marked SYSTEM in #1. Enter:

```
COPY,0,1,CMD,OV,LOW,SYS  
LINK,1,DOS
```

Then build your STARTUP file. The instructions came with your SWTPC disk system, and you're interested mostly in TTYSET. The STARTUP file, or the file it calls in, must end with EXEC,0,BOOKS.BG. This loads the end-of-period/end-of-year binary program, the BASIC interpreter, and a housekeeping binary program when the system is booted up.

Now remove the SYSTEM disk from #1 and replace it with the BASIC disk (which has all the programs on it). Enter:

```
COPY,0,EXEC,CMD  
COPY,0,COPY,CMD
```

Take your miniFLEX disk out of #0 and store it away. Take the BASIC disk out of #1 and place it in #0. Place your newly made SYSTEM disk back in #1 and enter:

```
EXEC,0,BOOKS.ICL
```


The system takes over from this point, and puts the system programs on the system disk. It then requests you to put a JOURNAL, GENERAL LEDGER (G/L), and ACCOUNTS PAYABLE (A/P) disk on #1. Do what it says, and then enter Y. NOT!! The programs at this point aren't sophisticated. They wait to fetch a character, ANY CHARACTER, from the keyboard, (to give you time to change disks), and then they take off again. So change disks BEFORE hitting anything! Since you will need at least two of each data disk, your first answer to the 'another set' question should be 'Y', (no 'return'; just Y). After you have made as many sets as you need (or can afford), enter N. The system will respond with the familiar +++.

At this point, all the disks have their minimum contents. You will now need your own particular data to flesh out the skeletons. After reading the rest of the instructions, get some paper and write down your chart of accounts and their balances. Don't waste your time trying to calculate your net worth. The computer will do that for you.

Power up your computer and put the SYSTEM disk in #0. Enter 'D'. When the system responds READY #, enter: CHAIN 0,INSTALL.

The first file you will build is the parameter file. We need the highest possible account numbers for each of the six categories: income, receivables, assets, expenses, payables, and net worth. (See the sample chart for an example.)

The next file will be the accounts payables. Before putting on A/P disk in the drive, get a label and write today's date on it. Stick it on the disk. The last thing you want is to get the disks mixed up.

The information requested for A/P is:

ACCT #
DESCRIPTION
BALANCE
PAYMENT
DATE DUE.

The first three are self-explanatory. The payment entry is used by the cash required program, and should be the amount you expect to pay on the date due. If the payment field is zero, the program assumes the entire balance is due (not so cool in the case of the mortgage). The date due can be either an MMDD format (325 = March 25th) or a DD format (10 = 10th of every month). If the date due is zero, then the program assumes you don't have to pay this one until you want to, and it ignores the account.

The last two entries (payment and date due) can be null entered (return), in which case they default to zero.

When all the accounts payable have been entered, you exit the routine by pressing 'return' without an account number.

Did you get the data on the A/P disk? Good.

Now put one on a general ledger disk. The G/L files are identical to the A/P files, except there aren't any payments or dates due.

When you are finished with the general ledger entries, you exit the routine the same as accounts payable.

Since the A/P file is already built, there is no reason to enter the data twice. The program will build the A/P section of the G/L, compute the net worth, and call in the START program.

Enter today's date and you're finished.

PLEASE, PLEASE, PLEASE, keep track of which disks are current. The small Avery labels are inexpensive, and worth their weight in gold. I have seen a couple sites update from an old disk to their current disk, (creating a colossal mess. Some never recover.

BOOKS.S C

10		NAM	BOOKS	
20		OPT	O,S,NOP,NOG	
30	START	EQU	\$2442	SWTPC BASIC 3.0 END
40	PDATA	EQU	\$E07E	SWTBUG
50	INEEE	BOU	\$E1AC	SWTBUG
60	FLXFCB	BOU	\$7809	FLEX 1.0 FCB POINTER
70	PBEG	BOU	\$A044	SWTBUG
80	PEND	BOU	\$A004	SWTBUG
90	PCHON	EQU	\$E14D	SWTBUG
100	PUNCH	EQU	\$E37E	SWTBUG
110	PCHOFF	EQU	\$E353	SWTBUG
120	DELAY	EQU	\$E2C2	SWTBUG
130	FMS	EQU	\$7806	FLEX 1.0 FMS ENTRY
140	BUF	EQU	\$78A4	FLEX 1.0 DISC BUFR
150	USER	EQU	\$5D	BASIC 3.0 USER(0)
160	BASIC	EQU	\$100	BASIC 3.0 COLD ENTRY
170	BASPGM	EQU	\$14E	BASIC 3.0 START OF PGMS
180	DOSENT	EQU	\$32A	BASIC 3.0 JUMP TO DOS
190	FLXWRM	EQU	\$7103	FLEX 1.0 WARM START
200	FLXCOLD	EQU	\$7100	FLEX 1.0 COLD START
210	R N	EQU	\$E334	SWTBUG
220	JNCH	EQU	\$E078	SWTBUG
230	CKSM	EQU	\$A00F	SWTBUG
240	BYTE	BOU	\$B055	SWTBUG
250	BYTECT	BOU	\$A047	SWTBUG
260	BADDR	BOU	\$E047	SWTBUG
270	OUTCH	BOU	\$E075	SWTBUG
280	RDOFF	EQU	\$E347	SWTBUG
285		ORG	START	
290	2442	JMP	BOOT	CNTL SYNG ENTRY
300	2445	JMP	ZOJNL	JOURNAL PUNCH
310	2442	JMP	ZOGL	GL PUNCH
320	2448	JMP	ZJNL	JOURNAL READ
330	244E	JMP	ZJHST	HJST READ
340	2451	JMP	ZJGL	GL READ
350		ZOJNL	LDX	#MSG01 INITIAL M SSAGES
360			JSR	PDATA
370			LDX	#MSG03
380			BRA	OMES1
390		ZOGL	LDX	#MSG01
400			JSR	PDATA
410			LDX	#MSG02
420		OMES1	JSR	PDATA
430			LDX	#MSG04
440			JSR	PDATA
450			LOX	#MSG07
460			JSR	PDATA
470		OMES2	LOX	#MSG08
480			JSR	PDATA
490			JSR	JNEEE
500		CMPPA	#SD	
510		ONS	OMES2	
520		LDAA	FLXFCB+1	GET ADDRESS OF FILE
530		LDAB	FLXFCB	
540		SUBA	#51C	
550		SBCB	#0	
560		STAA	FCB+1	
570		STAB	FCB	
580		LDX	#BUF	
590		STX	CURPOS	
600		STX	PBEG	
610		LDAB	#11	GET LABEL READY FOR PUNCH
620		LDX	FCB	
630	OLABEL	LDAA	4,X	
640		INX		
650		STX	TEMP	
660		LDX	CURPOS	
670		STAA	0,X	
680		INX		
690		STX	CURPOS	
700		LDX	TEMP	

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Modular plug-in construction with computer grade filters and a 25 AMP rectifier bridge. Blower fan is standard equipment. All connections to the power line are beneath the safety shield.

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CABINET

Rugged 1/8 inch alloy aluminum base plate combined with a solid 1/8 inch alloy aluminum cover for unsurpassed protection. All interior metal is conversion coated. The cover is finished with a super tough textured epoxy.

MEMORY— You can purchase the computer with either 8K bytes of RAM memory (expandable to 56K), or with the full 56K. The efficient, cool running dynamic memory used in this system is designed and manufactured for us by "Motorola Memory Systems Inc."

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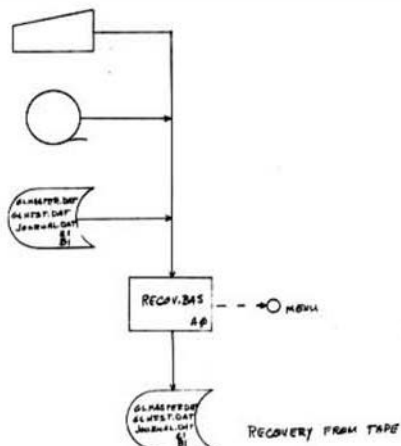
710		DGCB		1750		LDX	#MSG03	
720		BNE	OLABEL	1760		BRA	IMES1	
730		LDX	CURPOS	1770	ZIH87	LDX	#MSG01	
740		DGCB		1780		JSR	PDATA	
750		STX	PEND	1790		LDX	#MSG02	
760		JSR	PCHON	1800	IMES1	JSR	PDATA	
770		JSR	DELAY	1810		LDX	#MSG04	
780		JSR	DELAY	1820		JSR	PDATA	
790		JSR	DELAY	1830		LDX	#MSG06	
800		JSR	PUNCH	1840		JSR	PDATA	
810		LDX	#89	1850	IMES2	LDX	#MSG08	
820		JSR	PDATA	1860		JSR	PDATA	
830		JSR	PCHOFF	1870		JSR	INEEE	
840		LDX	FCB	1880		CMPPA	#SD	
850		LDAA	0,X	1890		BNE	IMES2	
860		STAA	0,X	1900	ZIGL	LDAA	FLX/FCB+1	ENTRY FOR NO MESSAG
870		JSR	FMS	1910		LDAB	FLX/FCB	GET ADDRESS OF FIL.
880	PREC1	LDX	#BUF	1920		SUBA	010C	
890		STX	CURPOS	1930		SUBC	#0	
900	PCHR1	LDX	FCB	1940		STAA	FCB+1	
910		JSR	FMS	1950		STAB	FCB	
920		TST	1,X	1960		JSR	LOAD	1ST RECORD OF TAPE
930		BNE	ODRR	1970		LDX	FCB	
940		LDX	CURPOS	1980		STX	TEMP	
950		STAA	0,X	1990		LDX	#BUF	
960		INX		2000		STX	CURPOS	
970		STX	CURPOS	2010	LAB1	LDAB	011	VERIFY LABEL
980		CPX	#BUF+125	2020		LDX	TEMP	
990		BNE	PCHR1	2030		LDAA	4,X	
1000	PCHR2	LDX	#BUF	2040		INX		
1010		STX	PREG	2050		STX	TEMP	
1020		LDX	CURPOS	2060		LDX	CURPOS	
1030		DGCB		2070		CMPPA	0,X	
1040		STX	PEND	2080		BNE	BADLAB	WRONG TAPE
1050		JSR	PCHON	2090		INX		
1060		JSR	DELAY	2100		STX	CURPOS	
1070		JSR	DELAY	2110		DGCB		
1080		JSR	DELAY	2120		BNE	LAB1	
1090		JSR	PUNCH	2130		LDX	FCB	LAB 1 OK
1100		LDX	#89	2140		LDAA	04	
1110		JSR	PDATA	2150		STAA	\$22,X	RESET DATA INDEX
1120		JSR	PCHOFF					
1130		LDX	FCB					
1140		TST	1,X	2230	2160 - 2220 deleted	IREC	LDX	#BUF
1150		BEO	PREC1	2240			LDAA	05FF
1160		BRA	ONODRR	2250		IFILL	LDAB	0124
1170	ODRR	LDAB	1,X	2260			STAA	0,X
1180		CMPPB	08	2270			INX	
1190		BEO	PCHR2	2280			DECB	
1200	ONODRR	LDX	FCB	2290			BNE	IFILL
1210		LDAA	1,X	2300			JSR	LOAD
1220		LDX	USER	2310			LDX	#BUF
				2320			LDAA	0,X
1240		CLRB		2330		ICHR	CMPPA	#5FF
1250		TSTA		2340			BEO	IREC
1260		BEO	USER4	2350			CMPPA	04
1270		CMPPA	#8	2360			BEO	IDONE
1280		BNE	USER2	2370			INX	
1290		CLRA		2380			STX	CURPOS
1300	USER2	DDA	#0	2390			LDX	FCB
1310		DAA		2400			JSR	FMS
1320		BITA	#5F0	2410			LDAA	1,X
1330		BEO	USER4	2420			BNE	IERR
1340		TAB		2430			LDX	CURPOS
1350		LSRA		2440			CPX	#BUF+125
1360		LSRA		2450			BNE	ICHR
1370		LSRA		2460			BRA	IREC
1380		LSRA		2470		BADLAB	LDAA	08
1390		ASLB		2480			BRA	ICLO1
1400		ASLB		2490		IERR	LDX	FCB
1410		ASLB		2500			LDAA	1,X
1420		ASLB		2510			BRA	ICLO1
				2520			CLRA	
				2530		IDONE	LDX	USER
1440	USER4	CLR	5,X			ICLO1		SET UP USER00
1450		STAA	0,X					
1460		BEO	USER5	2550			CLRB	
1470		INC	6,X					
1480	USER5	STAB	1,X	2580			ADDA	#0
1490		BEO	USER6	2590			DAA	
1500		INC	6,X	2600			BITA	#5F0
1510	USER6	INX		2610			BEO	ICLO3
1520		LDAB	04	2620			TAB	
1530	USER1	CLR	1,X	2630			LSRA	
1540		INX		2640			LSRA	
1550		DGCB		2650			LSRA	
1560		BNE	USER1	2660			LSRA	
1570		LDX	#BUF	2670			AS 0	
1580		LDAA	04	2680			ASLB	
1590		STAA	0,X	2690			ASLB	
1600		STAA	1,X	2700			ASLB	
1610		STX	PREG					
1620		INX		2720		ICLO3	CLR	6,X
1630		STX	PEND	2730			STAA	0,X
1640		JSR	PCHON	2740			BEO	ICLO4
1650		JSR	DELAY	2750			INC	6,X
1660		JSR	DELAY	2760		ICLO4	STAB	1,X
1670		JSR	DELAY	2770			BEO	ICLO5
1680		JSR	PUNCH	2780			INC	6,X
1690		LDX	#89	2790		ICLO8	INX	
1700		JSR	PDATA	2800			LDAB	04
1710		JSR	PCHOFF	2810		TCLO1	CLA	1,X
1720		RTS		2820			INX	
1730	ZUML	LDX	#MSG01	2830			DGCB	
1740		JSR	PDATA	2840			BNE	TCLO1
				2850			RTS	

```

2860 MSG01 FDB $1016.0.0
2870 FCC /THE /
2880 FCC 4
2890
2900 MSG02 FCC /GENERAL LEDGER/
2910 FCC 4
2920 MSG03 FCC /JOURNAL/
2930 FCC 4
2940 MSG04 FDB $D0A
2950 FCC /IS READY FOR TAPE./
2960 FCC $D, $A, $A
2970 FCC /SET BAUD AT 300 FOR K. C. STD./
2980 FCC $D0A
2990 FCC /TAPE./
3000 FCC $D, $A, $A
3010 FCC /PUT TAPE IN RECORDER AND/
3020 FCC $D0A
3030 FCC /PREPARE TO /
3040 FCC 4
3050 MSG05 FCC /READ./
3060 FCC 4
3070 MSG07 FCC /RECORD./
3080 FCC 4
3090 MSG08 FCC $D, $A, $A
3100 FCC /RETURN WHEN READY. ? /
3110 MSG FCC /GS/
3120 FCC 4
3130 TEMP RMB 2
3140 CURPOS RMB 2
3150 FCC RMB 2
3160 LOAD JSR RDON SWTBUG READ MODIFIED
3170 LOAD3 JSR INCH AS SUBROUTINE
3180 CMPA #1S
3190 BNE LOAD3
3200 JSR INCH
3210 CMPA #19
3220 BDC LOAD21
3230 CMPA #11
3240 BNE LOAD3
3250 CLR CKSM
3260 JSR BYTE
3270 SUBA #2
3280 STAA BYTECT
3290 JSR BADDR
3300 LOAD11 JSR BYTE
3310 DBC BYTECT
3320 BDC LOAD15
3330 STAA 0,X
3340 CMPA 0,X
3350 BNE LOAD19
3360 INX
3370 BRA LOAD11
3380 LOAD15 INC CKSM
3390 BDC LOAD3
3400 LOAD19 LDAA #17
3410 JSR OUTCH
3420 LOAD21 JSR RDDEF
3430 RTS
3440 DOS LDX #FLXWRM FIRST FLEX ENTR MUST
3450 STX DOSENT BE COLD
3460 JMP FLXCLD
3470 BOOT LDX #DOS INITIALIZE BASIC
3480 STX DOSENT
3490 LDX #ROOT
3500 STX BASPGM
3510 JMP BASIC
3520 2780 DONE FDB * FIND END OF PGM FROM
3530 END END SYMBOL TABLE

```

NOTE: Object file = BOOKS.81N,2442,277F,2442



SAMPLE CHART OF ACCOUNTS

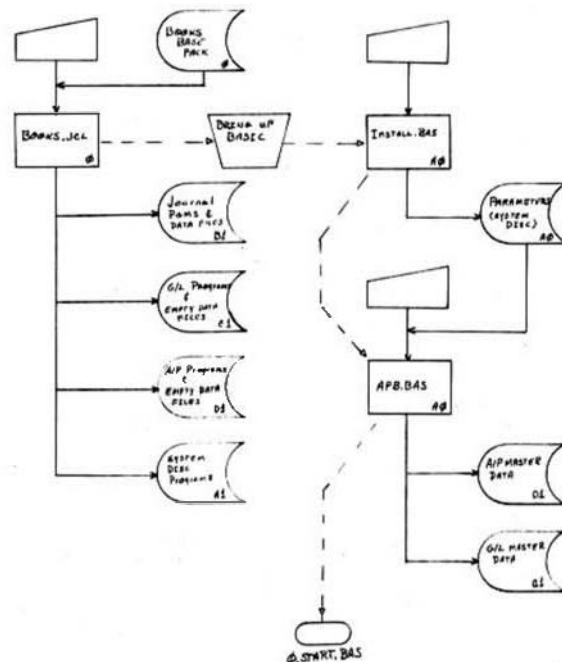
111	Dad's income	431	furnishings under \$100
121	Mom's income	432	furnishings over \$100
		491	books, magazines...
131	XYZ capital gains	511	Dad's allowance
132	ABQ capital gains	512	Mom's allowance
141	golden savings interest	520	food
142	roy savings interest	530	babysitters
151	XYZ dividends	540	tuition
152	ABQ dividends	550	medical
		560	personal insurance
200 - 299	acct's receivable (half)	571	Dad's clothing
		572	Mom's clothing
311	XYZ stock	573	kid #1 clothing
312	ABQ stock	574	kid #2 clothing
		575	kid #3 clothing
321	golden savings	581	Christmas gifts
322	roy savings	582	other gifts
323	wife's savings (double ha)	583	united appeal &c.
324	checking	584	Cr card interest \$\$\$
331	house	585	church donations
332	cars	586	Merrill Lynch donations
333	furniture &c.	589	misc. misc.
334	appliances		
335	other (computer)	611	Dad's gas and oil
		612	maintenance
412	interest on house note	613	insurance
413	house insurance	614	company reimbursed
414	house taxes	621	wife's gas & oil
		622	wife's car maint
421	gas & elect	623	wife car ins
422	water		
423	phone	711	dad fed withheld
424	elect maint	712	dad fica
425	plumbing maint	713	dad state donations
426	heating maint	714	wife fed withheld
427	general repairs	722	wife fica
429	other	723	wife state tax

SAMPLE CHART OF ACCOUNTS (cont)

Sample entries for parameter build, using the above chart:

811	DEF Insurance	INCOME	199
812	credit card #1	RECEIVABLES	299
813	mortgage	ASSETS	399
814	dept store #1	EXPENSES	799
815	dept store #2	PAYABLES	899
816	credit card #2	NET WORTH	900
817	credit card #3		
...			

900 Net Worth



A SOFTWARE DATA ENCRYPTON STANDARD IMPLEMENTATION FOR THE 6800

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The University of West Florida
Pensacola, FL 32504

The security of digital communications is becoming of great importance as the use of distributed systems becomes commonplace. Several systems for encrypting sensitive data have recently appeared in the literature, and some controversy has arisen over the relative security of these systems. The purpose of this article is to describe a 6800 software implementation of one of these systems, the National Bureau of Standards Data Encryption Standard (DES). This particular standard was developed by NBS in response to the requirement for a single certifiable standard to be used for all federal government unclassified data stored and transmitted by computer.

The contract to develop the standard was issued to IBM in 1974. During the development phase of the program, the National Security Agency was consulted regarding certain aspects of the standard, one of which was the key length. This fact led to speculation that perhaps the NSA had "tampered" with the encryption algorithm, creating a weakness which only they could exploit. The NBS Data Encryption standard was adopted on November 23, 1976, with an effective date of July 15, 1977. After this date, all federal agencies were required to comply with the standard. On April 13, 1978, the United States Senate Select Committee on Intelligence issued a report which, among other things, concluded that NSA did not tamper with the design of the DES algorithm in any way. And so, the DES exists today as the single method by which encryption of nonclassified data within all federal agencies is accomplished.

The Data Encryption Standard is thoroughly described in Federal Information Processing Standards (FIPS) Publication 46, U.S. Department of Commerce, National Bureau of Standards, issued on January 15, 1979. It is described as "an algorithm to be implemented in electronic hardware devices" and not by software. The 6800 user who can utilize the Motorola Exorcisor bus configuration can purchase a data security module which will encrypt a 64-bit block of data in less than 200 microseconds, and which has been

certified by the NBS. The cost is around \$500. Those computer users with a requirement for data encryption not involving any federal agency, or those merely wishing to experiment with data encryption, can use a software implementation of the algorithm. Such software implementations offer the same immunity to cryptanalysis as the hardware versions, in that the best machines available for the next few years would take some 200 years to break the code.

Since the DES algorithm is fully explained in FIPS Publication 46, only the rudiments will be discussed here. The algorithm utilizes a 64 bit input block, a 64 bit output block, and a 64 bit key of which 56 bits are actually used as the key, with the remaining eight bits being reserved for parity checks on the key itself. The 64 bit input block is first passed through an initial permutation (IP) which shuffles the input bits in accordance with a specified permutation table. The resulting 64 bit permuted input is then split into two 32 bit blocks, L and R, such that the permuted input block is LR. The L and R blocks are then passed through 16 iterations of a calculation described below in terms of a cipher function f. Successive functions L_m and R_m are determined by the recursive equations

$$\begin{aligned} L_m &= R_{m-1} \\ R_m &= L_{m-1} \oplus f(R_{m-1}, K_m) \end{aligned}$$

where initial values L_0 and R_0 are those resulting from initial division of the permuted input block, and where \oplus represents the bit-by-bit exclusive OR operation. The subkey K_m is a block of 48 bits chosen from the 64 bit key in accordance with the expression

$$K_m = KS(M, KEY)$$

where KEY is the 64 bit input key, KS is a function called the key schedule, and K_m is determined by the bits in 48 distinct bit positions within KEY, as specified by the key schedule. The KS function consists of putting the 64 bit key through a specified permutation and bit selection process (PC-1), resulting in two 28 bit blocks termed C_0 and D_0 . These blocks are then left shifted in accordance with a specified schedule to generate C_m and D_m for each of the sixteen iterations. The block $C_m D_m$ is then passed through a second permutation and bit selection process (PC-2) to produce K_m , a 48 bit block used as the subkey for iteration M.

Finally, the cipher function $f(R_{m-1}, K_m)$ is determined by first forming a 48 bit function $E(R_{m-1})$ from the 32 bit R_{m-1} block by means of a specified bit selection table, exclusive OR-ing this block with the 48 bit subkey K_m , and then passing each six bit block of the result through a specified selection function, S_1, S_2, \dots, S_8 . These so called "S-boxes" generate eight four bit blocks, one from each of the six bit blocks, which combine to form a 32 bit result. This result then undergoes a final permutation P to produce the 32 bit cipher function $f(R_{m-1}, K_m)$. The 32 bit R_m is then determined from f and L_{m-1} as described above.

When L_{16} and R_{16} are finally determined, the 64 bit block $L_{16}R_{16}$ is passed through the inverse of the initial permutation (IP^{-1}) to yield the 64 bit output ciphertext. To decrypt a ciphertext encoded by the DES algorithm, it is necessary only to process the encrypted block through the same algorithm, only now the subkeys K_n are generated in reverse order.

The algorithm itself is fairly complex but the procedures, including the permutations, bit selections, shift schedules, and the S-boxes themselves, are public knowledge and are fully described in FIPS Publication 46. The only thing which needs to be kept secret is the key. The reasons behind the particular selection of these various functions by NBS is not obvious to those unfamiliar with cryptographic techniques, but it must be assumed that the selections and procedures were chosen to enhance the security of the algorithm against cryptanalysis. In fact, it is the design of the S-boxes themselves, which has never been explained by IBM, NBS, or NSA, which has led to the speculation of tampering.

The particular software version of the DES described below was written for a SWTP 6800 microcomputer using the FLEX operating system, and requires approximately 1100 bytes of memory. The permutation routine PERM is used most often and with various inputs, outputs, and permutation tables. A parameter table is used to indicate to the permutation routine the number of bits in the output byte, the number of output bytes, the location of input and output blocks, and the desired permutation table. All permutation tables are stored in the format mmmmbbbb as described in the program listing. The mask number mmmm gives the location of the source bit

within the source byte. The bbbb gives the location within the input of the byte which contains the desired bit. The desired bit is masked out and shifted into a holding byte which, when full, is stored in the output block.

Routine SHIFT generates the shifting operation necessary for generation of the subkeys. Since each subkey corresponds to a specific iteration of L and R, it is used only once in the encryption of a given 64 bit input block. This makes it possible for the subkeys to be generated as they are needed, rather than having them stored in memory. This requires a shift routine which will handle both left and right shifting of 28 bit blocks of data.

The routine which requires the most memory and table searching is PERMS, which performs the S-box mapping. Since each element of an S-box can fit into a half byte, a compacted table is used so that two elements are contained in a single byte. To access an S-box entry, the row and column numbers are specified. The column number is then divided by two and added to the row number, which in turn is adjusted to the left half byte of the table pointer. This provides the table offset, which is added to the table address to get the byte containing the desired half-byte. The particular half-byte of interest is then determined, together with the specification of the half of the output byte into which it is to be stored.

The routine which actually performs the iterative procedures of the DES algorithm is ITER. It calls the various subroutines, and directs the logic flow for both encryption and decryption. It follows the iterative procedures described above for generating L_m , R_m , and K_m for each of the 16 iterative steps.

The main routine converts the DES program into a FLEX utility responding to the entry DES from a FLEX prompt. It responds with a user prompt for the DES parameters, and calls ITER to initiate the encryption or decryption. The DES parameters are:

- (1) MODE (00 = encrypt, 01 = decrypt)
- (2) KEY (16 hexadecimal digits)
- (3) INPUT (16 hexadecimal digits)

After the input data is entered, the system responds with the output of 16 hexadecimal

digits. A sample encryption followed by a decryption is shown following the program listing.

It will be noted that the main routine utilizes certain FLEX and MIKBUG (DISKBUG in this case) routines. These are not necessary unless something like the main routine is used to interface the program with FLEX. Also, the FLEX routine ADBX is used by two of the subroutines. This merely adds the B accumulator to the index register, and could be replaced by a user provided subroutine. It is used to provide a variable offset to the index register, permitting easier table access.

REFERENCES

FIPS Publication 46, "Data Encryption Standard," U.S. Department of Commerce, Bureau of Standards, January 15, 1977.

NBS Special Publication 550-20 "Validating the Correctness of Hardware." "Implementations of the NBS Data Encryption Standard," U.S. Department of Commerce, Bureau of Standards, November, 1977.

Mueshaw, R. V. "The Standard Data Encryption Algorithm, Part 1," BYTE, March, 1979.

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Davis, Ruth. "The Data Encryption Standard in Perspective," IEEE Communications Society Magazine, November, 1978.

"Unclassified Summary: Involvement of NSA in the Development of the Data Encryption Standard," U.S. Select Committee on Intelligence, IEEE Communications Society Magazine, November, 1978.

```

1      *** DDB
2      *****
3      * STANDARD DATA ENCRYPTION ALGORITHM *
4      *****
5      * AUTHOR: Sam J. La Cour Jr. *
6      *****
7      ORG 00000
8      0000 20 01  W  BRA  ENT
9      0002 01  FCB 1
10     0003 7E 03 19 ENT JUP 0000
11     0004 45 00000 FCB 0000
12     0028 04 00000 FCB 0000
13     002E 40 00000 FCB 0000
14     0041 04 00000 FCB 0000
15     0042 45 10000 FCB 0000
16     0044 04 00000 FCB 0000
17     0045 04 00000 FCB 0000
18     0047 04 00000 FCB 0000
19     0048 04 00000 FCB 0000
20     0049 04 00000 FCB 0000
21     004A 04 00000 FCB 0000
22     004B 04 00000 FCB 0000
23     004C 04 00000 FCB 0000
24     004D 04 00000 FCB 0000
25     004E 04 00000 FCB 0000
26     004F 04 00000 FCB 0000
27     0050 04 00000 FCB 0000
28     0051 04 00000 FCB 0000

```

```

29 007A K RND 8
30 0082 K1 RND 4
31 0084 INPUT RND 0
32 0086 C RND 4
33 0087 D RND 4
34 0088 0000 0000 0000 0000 0000 0000 0000 0000
35 0089 00 7A KADR FCB 4
36 0090 00 82 K1ADR FCB 001
37 0091 01 0F SAMR FCB 0
38 0092 KEY RND 0
39 0093 APARS RND 2
40 0094 PARS FCB 001.000
41 0095 INPUT,INTTAB FCB 000.004
42 0096 00 8A FCB 000.004
43 0097 00 0F FCB 000.004
44 0098 00 0F FCB 000.004
45 0099 00 0F FCB 000.004
46 009A 00 0F FCB 000.004
47 009B 00 0F FCB 000.004
48 009C 00 0F FCB 000.004
49 009D 00 0F FCB 000.004
50 009E 00 0F FCB 000.004
51 009F 00 0F FCB 000.004
52 00A0 00 0F FCB 000.004
53 00A1 00 0F FCB 000.004
54 00A2 00 0F FCB 000.004
55 00A3 00 0F FCB 000.004
56 00A4 00 0F FCB 000.004
57 00A5 00 0F FCB 000.004
58 00A6 00 0F FCB 000.004
59 00A7 00 0F FCB 000.004
60 00A8 00 0F FCB 000.004
61 00A9 00 0F FCB 000.004
62 00AA 00 0F FCB 000.004
63 00AB 00 0F FCB 000.004
64 00AC 00 0F FCB 000.004
65 00AD 00 0F FCB 000.004
66 00AE 00 0F FCB 000.004
67 00AF 00 0F FCB 000.004
68 00B0 00 0F FCB 000.004
69 00B1 00 0F FCB 000.004
70 00B2 00 0F FCB 000.004
71 00B3 00 0F FCB 000.004
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78 00BA 00 0F FCB 000.004
79 00BB 00 0F FCB 000.004
80 00BC 00 0F FCB 000.004
81 00BD 00 0F FCB 000.004
82 00BE 00 0F FCB 000.004
83 00BF 00 0F FCB 000.004
84 00C0 00 0F FCB 000.004
85 00C1 00 0F FCB 000.004
86 00C2 00 0F FCB 000.004
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93 00C9 00 0F FCB 000.004
94 00CA 00 0F FCB 000.004
95 00CB 00 0F FCB 000.004
96 00CC 00 0F FCB 000.004
97 00CD 00 0F FCB 000.004
98 00CE 00 0F FCB 000.004
99 00CF 00 0F FCB 000.004
100 00D0 00 0F FCB 000.004
101 00D1 00 0F FCB 000.004
102 00D2 00 0F FCB 000.004
103 00D3 00 0F FCB 000.004
104 00D4 00 0F FCB 000.004
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106 00D6 00 0F FCB 000.004
107 00D7 00 0F FCB 000.004
108 00D8 00 0F FCB 000.004
109 00D9 00 0F FCB 000.004
110 00DA 00 0F FCB 000.004
111 00DB 00 0F FCB 000.004
112 00DC 00 0F FCB 000.004
113 00DD 00 0F FCB 000.004
114 00DE 00 0F FCB 000.004
115 00DF 00 0F FCB 000.004
116 00E0 00 0F FCB 000.004
117 00E1 00 0F FCB 000.004
118 00E2 00 0F FCB 000.004
119 00E3 00 0F FCB 000.004
120 00E4 00 0F FCB 000.004
121 00E5 00 0F FCB 000.004
122 00E6 00 0F FCB 000.004
123 00E7 00 0F FCB 000.004
124 00E8 00 0F FCB 000.004
125 00E9 00 0F FCB 000.004
126 00EA 00 0F FCB 000.004
127 00EB 00 0F FCB 000.004
128 00EC 00 0F FCB 000.004
129 00ED 00 0F FCB 000.004
130 00EE 00 0F FCB 000.004
131 00EF 00 0F FCB 000.004
132 00F0 00 0F FCB 000.004
133 00F1 00 0F FCB 000.004
134 00F2 00 0F FCB 000.004
135 00F3 00 0F FCB 000.004
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138 00F6 00 0F FCB 000.004
139 00F7 00 0F FCB 000.004
140 00F8 00 0F FCB 000.004
141 00F9 00 0F FCB 000.004
142 00FA 00 0F FCB 000.004
143 00FB 00 0F FCB 000.004
144 00FC 00 0F FCB 000.004
145 00FD 00 0F FCB 000.004
146 00FE 00 0F FCB 000.004
147 00FF 00 0F FCB 000.004
148 0000 00 0F FCB 000.004
149 0001 00 0F FCB 000.004
150 0002 00 0F FCB 000.004

```



```

151 AD15      BEYD0 EQU 0AD15
152 AD24      PCRLF EQU 0AD24
153 AD18      PUTCHN EQU 0AD18
154          *****
155          * MAIN ROUTINE:
156          *
157          * FUNCTION: Prompt user for DES parameters and
158          *          invoke ITER to do the encryption
159          *          or decryption. The DES parameters
160          *          consist of:
161          *          (1) MODE (0=Encrypt, 1=Decrypt);
162          *          (2) KEY (8 hex bytes);
163          *          (3) INPUT DATA (8 hex bytes).
164          *
165          * EXTERNAL ROUTINES:
166          *
167          *
168          *
169          *
170          *
171          *****
172 0310 00 00 24  RA3H  JBR  PCRLF
173 031C CE 00 04  LBR  (PCORR0)
174 031F 00 00 7E  JBR  PBATA1
175 0322 00 00 24  JBR  PCRLF
176 0325 00 00 55  JBR  BYTE
177 0328 07 00 16  B1A 0 0100
178 032A 00 00 24  JBR  PCRLF
179 032D CE 00 2E  LDI  03E70004
180 0330 00 00 7E  JBR  PBATA1
181 0333 00 00 24  JBR  PCRLF
182 0336 CE 00 00  LBR 0 000
183 0339 CE 00 0F  LBR 0 000
184 033C 37 00 00  JBR 0 000
185 033F 00 00 33  STA  A 0,X
186 0341 00 00 00  INX
187 0342 32 00 00  PLA  B
188 0343 30 00 00  DEC  B
189 0344 2E 00 00  NOT  034E
190 0345 30 00 24  JBR  PCRLF
191 0346 30 00 42  LBR  03E70000
192 0347 30 00 7E  JBR  PBATA1
193 0348 30 00 24  JBR  PCRLF
194 0349 30 00 00  LBR 0 000
195 034A 30 00 04  LBR 0 0100
196 034B 30 00 00  JBR 0 000
197 034C 37 00 00  JBR 0 000
198 034D 30 00 00  JBR 0 000
199 034E 07 00 00  INX
200 034F 30 00 00  PLA  B
201 0350 30 00 00  DEC  B
202 0351 30 00 00  NOT  0351
203 0352 30 00 24  JBR  PCRLF
204 0353 30 00 00  LBR 0 000
205 0354 30 00 00  LBR 0 0100
206 0355 30 00 00  JBR 0 000
207 0356 30 00 00  LBR 0 0100
208 0357 30 00 00  JBR 0 000
209 0358 30 00 00  JBR 0 000
210 0359 30 00 00  JBR 0 000
211 035A 30 00 00  JBR 0 000
212          *****
213          * SUBROUTINE: SHIFTR
214          *
215          *
216          * FUNCTION: Rotate 20 bits pointed to by X
217          *          either left or right depending on
218          *          the value in "DIR" (0 for left,
219          *          1 for right). The result is stored
220          *          in the source field.
221          *
222          * EXTERNAL ROUTINES: NONE
223          *
224          *****
225 0376 36 00 00  SHIFTR  PSW  A  Save accumulators A and B.
226 0377 37 00 00  PSW  B
227 0378 30 00 00  PSW  B
228 0379 04 00 03  LBR  A 3,X
229 037A 04 00 00  AND  A 00F0
230 037B 07 00 03  STA  A 3,X
231 037C 32 00 00  PLA  A
232 037D 00 00 01  B1A 0 0001
233 037E 27 00 15  CWP  03E70001
234 037F 00 00 03  LBR  A 3,X
235 0380 00 00 03  LBR  A 3,X
236 0381 00 00 02  ROL  2,X
237 0382 00 00 01  ROL  1,X
238 0383 00 00 00  ROL  0,X
239 0384 00 00 0F  AND  A 000F
240 0385 04 00 00  AND  A 00F0
241 0386 07 00 03  STA  A 3,X
242 0387 36 00 00  DEC  B
243 0388 2E 00 10  NOT  0388
244 0389 20 00 17  B1A 0 0100
245 038A 00 00 00  LBR 0 000
246 038B 00 00 01  ROR  1,X
247 038C 00 00 02  ROR  2,X
248 038D 00 00 03  ROR  3,X
249 038E 00 00 03  LBR  A 3,X
250 038F 00 00 00  AND  A 0000
251 0390 00 00 00  AND  A 0,X
252 0391 00 00 00  AND  A 0,X
253 0392 00 00 00  AND  A 0,X
254 0393 00 00 00  AND  A 0,X
255 0394 00 00 00  AND  A 0,X
256 0395 00 00 00  AND  A 0,X
257 0396 00 00 00  AND  A 0,X
258 0397 00 00 00  AND  A 0,X
259 0398 33 00 00  OUT00F  PSW  A
260 0399 32 00 00  PSW  B
261 039A 39 00 00  PSW  B
262          *****
263          * SUBROUTINE: ITER
264          *
265          *
266          * FUNCTION: Actually the main DES routine, ITER
267          *          calls all other DES routines and
268          *          directs logic flow for either
269          *          encryption or decryption.
270          *
271          * EXTERNAL ROUTINES: NONE
272          *
273          *****

```

```

274 039D CE 00 0F  ITER  LBR  03A000
275 039E 0F 00 05  STX  STLOC
276 039F 3F 00 7E  LBR  03277E
277 03A0 0F 00 07  STX  SKUIN
278 03A1 00 00 04  JBR  PCORR0
279 03A2 00 00 04  JBR  PERM
280 03A3 00 00 04  JBR  PERM
281 03A4 00 00 04  JBR  PERM
282 03A5 00 00 04  JBR  PERM
283 03A6 00 00 04  JBR  PERM
284 03A7 00 00 04  JBR  PERM
285 03A8 00 00 04  JBR  PERM
286 03A9 00 00 04  JBR  PERM
287 03AA 00 00 04  JBR  PERM
288 03AB 00 00 04  JBR  PERM
289 03AC 00 00 04  JBR  PERM
290 03AD 00 00 04  JBR  PERM
291 03AE 00 00 04  JBR  PERM
292 03AF 00 00 04  JBR  PERM
293 03B0 00 00 04  JBR  PERM
294 03B1 00 00 04  JBR  PERM
295 03B2 00 00 04  JBR  PERM
296 03B3 00 00 04  JBR  PERM
297 03B4 00 00 04  JBR  PERM
298 03B5 00 00 04  JBR  PERM
299 03B6 00 00 04  JBR  PERM
300 03B7 00 00 04  JBR  PERM
301 03B8 00 00 04  JBR  PERM
302 03B9 00 00 04  JBR  PERM
303 03BA 00 00 04  JBR  PERM
304 03BB 00 00 04  JBR  PERM
305 03BC 00 00 04  JBR  PERM
306 03BD 00 00 04  JBR  PERM
307 03BE 00 00 04  JBR  PERM
308 03BF 00 00 04  JBR  PERM
309 03C0 00 00 04  JBR  PERM
310 03C1 00 00 04  JBR  PERM
311 03C2 00 00 04  JBR  PERM
312 03C3 00 00 04  JBR  PERM
313 03C4 00 00 04  JBR  PERM
314 03C5 00 00 04  JBR  PERM
315 03C6 00 00 04  JBR  PERM
316 03C7 00 00 04  JBR  PERM
317 03C8 00 00 04  JBR  PERM
318 03C9 00 00 04  JBR  PERM
319 03CA 00 00 04  JBR  PERM
320 03CB 00 00 04  JBR  PERM
321 03CC 00 00 04  JBR  PERM
322 03CD 00 00 04  JBR  PERM
323 03CE 00 00 04  JBR  PERM
324 03CF 00 00 04  JBR  PERM
325 03D0 00 00 04  JBR  PERM
326 03D1 00 00 04  JBR  PERM
327 03D2 00 00 04  JBR  PERM
328 03D3 00 00 04  JBR  PERM
329 03D4 00 00 04  JBR  PERM
330 03D5 00 00 04  JBR  PERM
331 03D6 00 00 04  JBR  PERM
332 03D7 00 00 04  JBR  PERM
333 03D8 00 00 04  JBR  PERM
334 03D9 00 00 04  JBR  PERM
335 03DA 00 00 04  JBR  PERM
336 03DB 00 00 04  JBR  PERM
337 03DC 00 00 04  JBR  PERM
338 03DD 00 00 04  JBR  PERM
339 03DE 00 00 04  JBR  PERM
340 03DF 00 00 04  JBR  PERM
341 03E0 00 00 04  JBR  PERM
342 03E1 00 00 04  JBR  PERM
343 03E2 00 00 04  JBR  PERM
344 03E3 00 00 04  JBR  PERM
345 03E4 00 00 04  JBR  PERM
346 03E5 00 00 04  JBR  PERM
347 03E6 00 00 04  JBR  PERM
348 03E7 00 00 04  JBR  PERM
349 03E8 00 00 04  JBR  PERM
350 03E9 00 00 04  JBR  PERM
351 03EA 00 00 04  JBR  PERM
352 03EB 00 00 04  JBR  PERM
353 03EC 00 00 04  JBR  PERM
354 03ED 00 00 04  JBR  PERM
355 03EE 00 00 04  JBR  PERM
356 03EF 00 00 04  JBR  PERM
357 03F0 00 00 04  JBR  PERM
358 03F1 00 00 04  JBR  PERM
359 03F2 00 00 04  JBR  PERM
360 03F3 00 00 04  JBR  PERM
361 03F4 00 00 04  JBR  PERM
362 03F5 00 00 04  JBR  PERM
363 03F6 00 00 04  JBR  PERM
364 03F7 00 00 04  JBR  PERM
365 03F8 00 00 04  JBR  PERM
366 03F9 00 00 04  JBR  PERM
367 03FA 00 00 04  JBR  PERM
368 03FB 00 00 04  JBR  PERM
369 03FC 00 00 04  JBR  PERM
370 03FD 00 00 04  JBR  PERM
371 03FE 00 00 04  JBR  PERM
372 03FF 00 00 04  JBR  PERM
373          *****
374          * SUBROUTINE: PERM
375          *
376          * FUNCTION: Performs bit mapping from input
377          *          to output using a mapping table.
378          *          Input/output and table are specified
379          *          in a parameter table which is
380          *          traversed serially each time
381          *          PERM is called. The mapping table
382          *          entries are in the form:
383          *          where nnn is a 3-bit number which
384          *          gives the location of the source
385          *          bit within the source byte.
386          *          The bits are numbered from 1 to 8.
387          *          bbbb gives the location within the
388          *          input of the byte which contains
389          *          the desired bit. These bytes are
390          *          numbered from 0 to 7.
391          *          The parameter list also gives the
392          *          number of bytes and the byte length
393          *          of the output.
394          *
395          * EXTERNAL ROUTINES:
396          *
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```


11/26/79

Mr. Don Williams
'68' Micro Journal
3018 Hamill Road
Nixson, TN 37343

Dear Mr. Williams:

You did not print the truth table of AND,NAND,OR,NOR,Ex.OR
in the article, "Logic Gate Tester", in Nov./Dec. 1979 issue
on page 33.

Enclosed please find the truth table for your correction.

Sincerely,

S. J. Young
S. J. Young
E. 36 Salmon Street
Spokane, WA 99218

Test Pattern	AND	NAND	OR	NOR	Ex.OR
0 0	0	1	0	1	0
0 1	0	1	1	0	1
1 0	0	1	1	0	1
1 1	1	0	1	0	0
Hex. Value	1	E	7	8	6
Displayed Character	A	n	O	Z	E

Test Pattern	Buffer	Inverter	Test Pattern	Hex. Value	Displayed Character
0	0	1	0	1	1
1	1	0	1	0	0
0	0	1	0	1	1
1	1	0	1	0	0
Hex. Value	5	A	Hex. Value	1	1
Displayed Character	U	I	Displayed Character	1	1

Clock	D-Input	J-Type Flip-Flop		J-K Flap-Flop J=K=1	
		Q	Q̄	Q	Q̄
0	0	1	0	0	1
1	0	0	1	0	1
0	1	0	1	1	0
1	1	1	0	1	0
Hex. Value		9	6	3	C
Displayed Character		F	E	F	F

November 27, 1979

'68 Micro Journal
3018 Hamill Road
Nixson, Tennessee 37343

Dear Mr. Williams:

While loading and debugging the Christmas File Program submitted by Mr. Paul Phelps in the Nov/Dec issue of '68 Micro Journal, I discovered a small error in the listing. On line 2200: FOR I = 1 to Y + 1 should be FOR I = 1 to Y. After I made this correction the Program ran perfectly.

I would also like to take this opportunity to plug what I think is one of the best Floppy Disk Systems available for 5550 buss computers, and this, of course, is Percom's LTD-400 Floppy Disk System. It comes from Percom with "Windows-Plus X" Percom's named file DOS in ROM.

Sincerely,

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Tracer: A 6800 Debugging Program is for the programmer looking for good debugging software. Tracer features single step execution using dynamic break points, register examination and modification, and memory examination and modification. This book includes detailed Tracer program notes and a reprint of "Jack and the Machine Debug" (from the December 1977 issue of BYTE magazine).

ISBN 0-931718-02-3 Pages: 24 Price: \$6

Authors: Robert D. Grappel & Jack E. Hemenway

MONDEB: An Advanced M6800 Monitor-Debugger has all the general features of Motorola's MIKBUG monitor as well as numerous other capabilities. Some of the command capabilities of MONDEB include displaying and setting the contents of registers, setting interrupts for debugging, testing a programmable memory range for bad memory locations, changing the display and input base of numbers, displaying the contents of memory, searching for a specified string, copying a range of bytes from one location in memory to another, and defining the location to which control will transfer upon receipt of an interrupt.

ISBN 0-931718-06-6 Author: Don Peters Pages: 88 Price: \$5

RA6800ML: An M6800 Relocatable Macro Assembler is a two pass assembler for the Motorola 6800 microprocessor. The Assembler can produce a program listing, a sorted Symbol Table listing and relocatable object code. The object code is loaded and linked with other assembled modules using the Linking Loader LINK68. There is a complete description of the 6800 Assembly language and its components. Each major routine of the Assembler is described in detail, complete with flow charts and a cross reference showing all calling and called-by routines, pointers, flags, and temporary variables. In addition, details on interfacing and using the Assembler and error messages generated by the Assembler are included. This book provides the necessary background for coding programs in the 6800 assembly language, and for understanding innermost operations of the Assembler.

ISBN 0-931718-10-4

Author: Jack E. Hemenway

Pages: 184 Price: \$25

LINK68: An M6800 Linking Loader is a one pass linking loader which allows separately translated relocatable object modules to be loaded and linked together to form a single executable load module, and to relocate modules in memory. It produces a load map and a load module in Motorola MIKBUG loader format. This book provides everything necessary for the user to easily learn about the system, including a detailed description of the major routines of the Linking Loader, including flow charts. While implementing the system, the user has an opportunity to learn about the nature of linking loader design as well as simply acquiring a useful software tool.

ISBN 0-931718-09-0



Authors: Robert D. Grappel & Jack E. Hemenway

Pages: 72 Price: \$8

Tiny Assembler 6800, Version 3.1 is a small (4 K) but sophisticated and useful assembler for a large subset of the Motorola 6800 assembly language. The book includes detailed notes on the design and implementation of Version 3.0 of the assembler, a complete description of the enhancements upgrading the Tiny Assembler to Version 3.1, an updated user's guide, and complete listings for both versions, making this book the most complete documentation possible for Jack Emmerich's Tiny Assembler.

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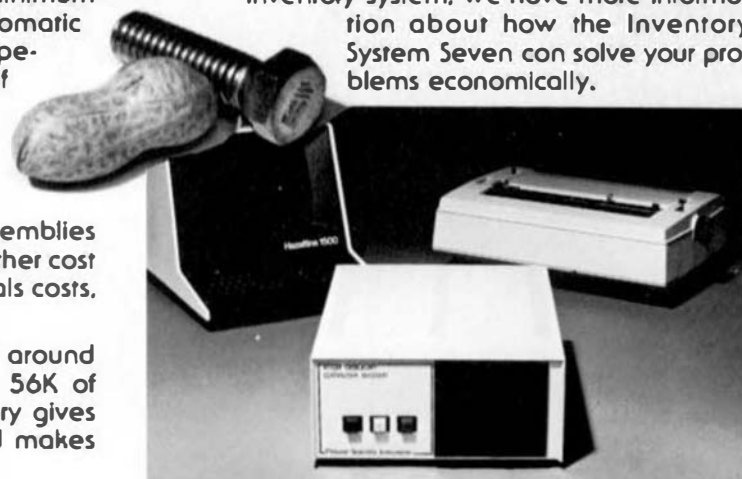
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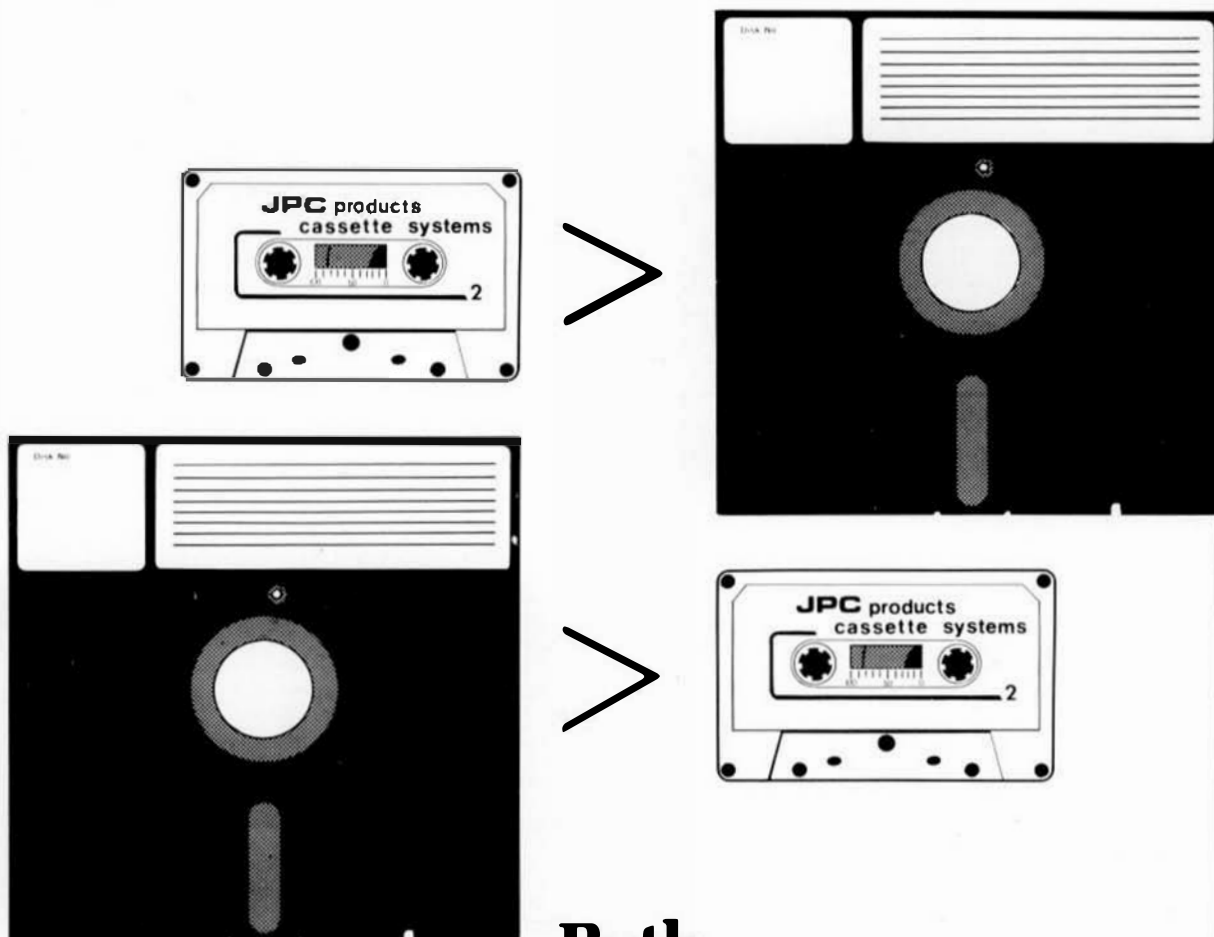


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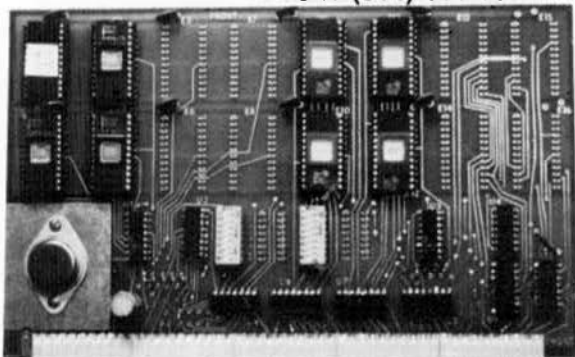


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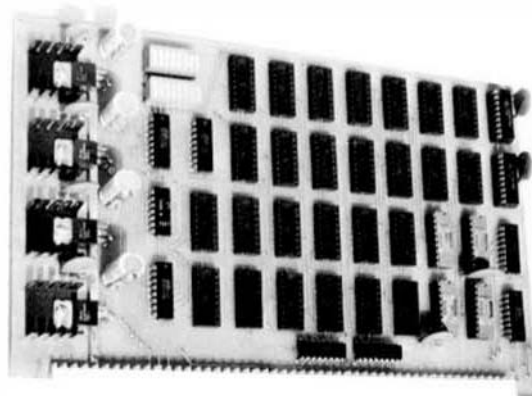


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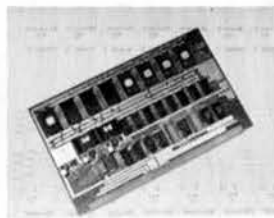


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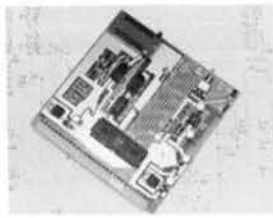
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See Gimix Ad on page 3



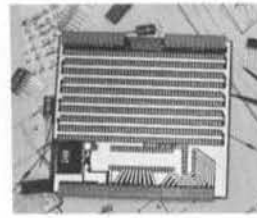
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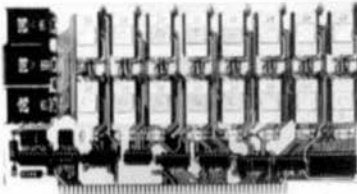
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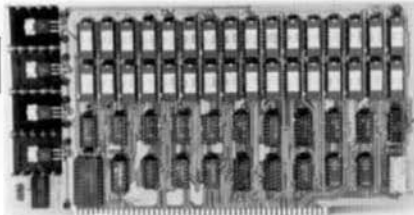
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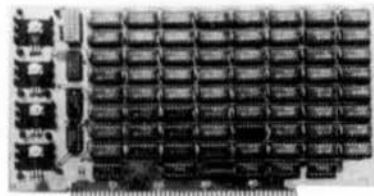
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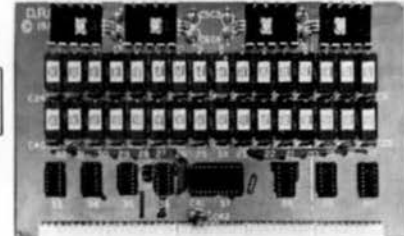
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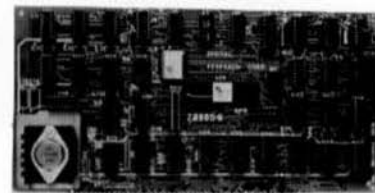
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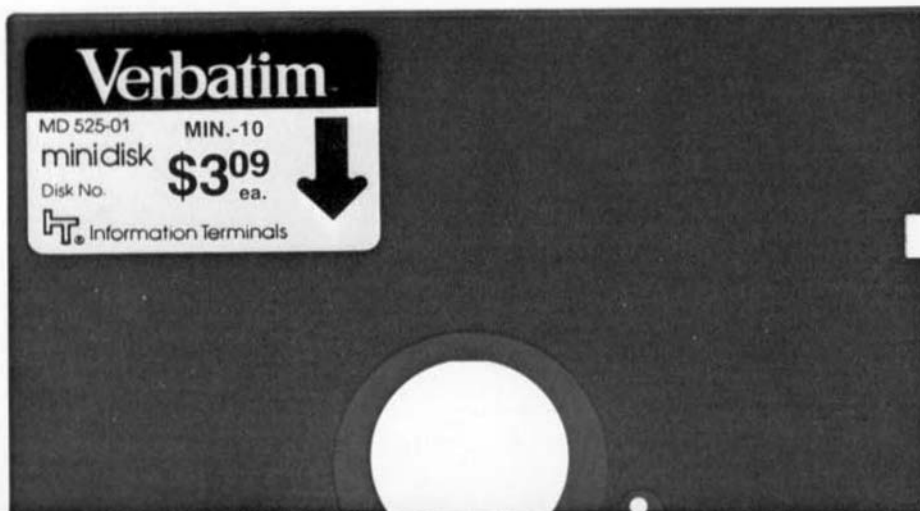
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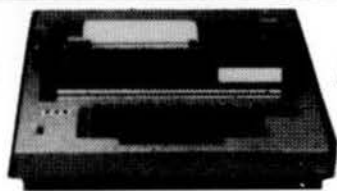
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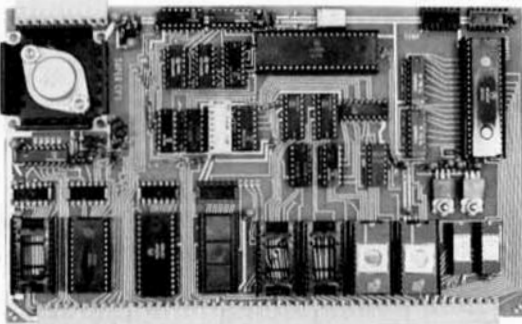
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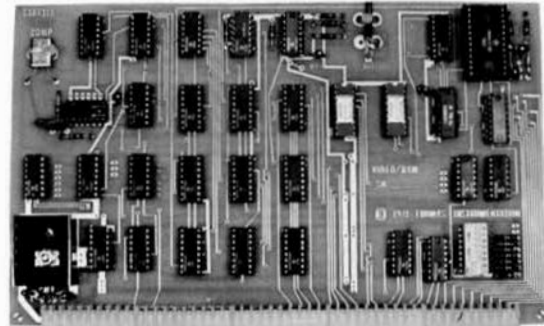
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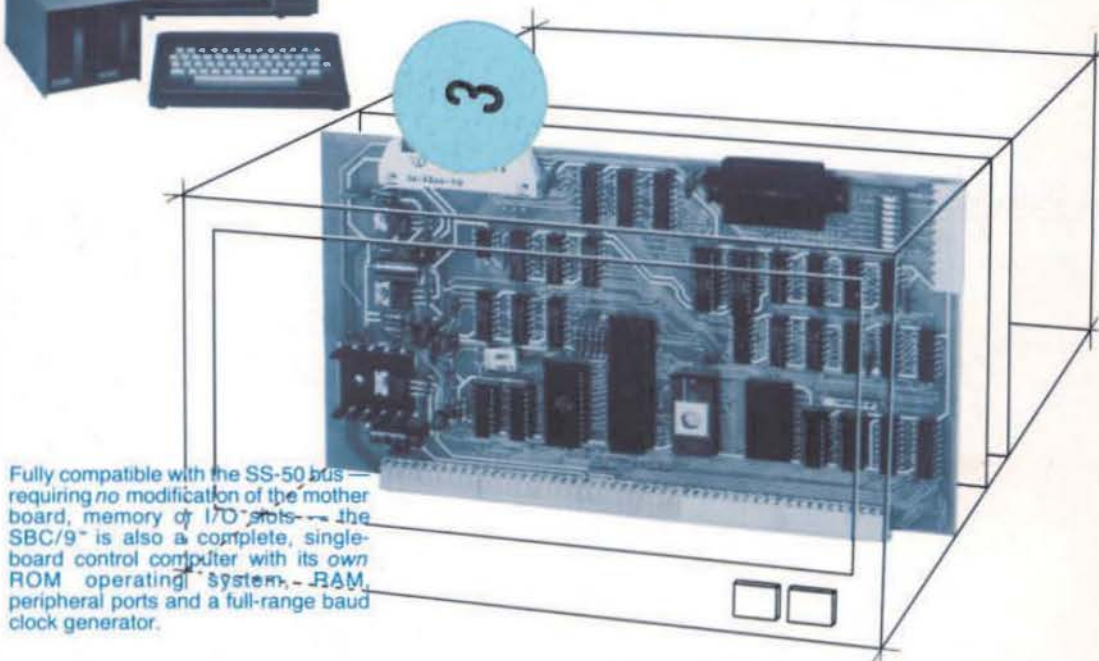
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